HUMAN PARASITIC INFECTIONS IN BALI : A REVIEW

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ABSTRACT

Parasitic infections in humans in Bali are well documented, especially in the population who lived in rural areas. The most common infections are those of the soil-transmitted helminthiasis which are caused by *Ascaris lumbricoides, Trichuris trichiura* and hookworm showing prevalence rates of 40 - 95%, 25 - 90% and 20 - 70% respectively. *Enterobius vermicularis* prevalence rate has been reported to be 18 - 53%. Taenniasis prevalence rate has been documented to be 0.8 - 23% in some villages, where *Taenia saginata* was found to be more prevalent than *Taenia solium,* and this might be due to the eating habit of the Balinese people who consumed both pork and beef lawar.

Malaria is still found in Bali especially in regions along the coasts of some regencies, although generally the infection rate is low. The prevalence rates of intestinal protozoa such as *Giardia lamblia, Entamoeba histolytica, Balantidium coli* have been occasionally reported in low percentages.

INTRODUCTION

Bali, being located entirely in the humid tropics as other parts of Indonesia, is indeed a suitable habitat for parasitic infections. These parasitic infections may insidiously or acutely harm the health and well-being of a big number of Bali's population, especially that majority who live in rural areas.

The aim of this paper is to briefly review some of the most common parasitic infections of man in Bali.

HELMINTHIC INFECTIONS

1. Soil-transmitted helminths

The most common infections of the soil-transmitted helminths are those caused by *Ascaris lumbricoides, Trichuris trichiura* and *hookworm*. Rasidi et al. did a survey in three separate villages, namely Padangsambian, Badung Regency, Sukawati, Gianyar Regency and Trunyan, Bangli Regency, where stool samples of over 500 children and adults were examined by formalin-ether concentration method. In Padangsambian, a semi-urban village 6 km west of Denpasar, it was found that 91.3 % of the people was infected by *Ascaris lumbricoides,* 89.9 % by *Trichuris trichiura* and 54.8 % by *hookworm*. In Sukawati, a rural village 25 km east of Denpasar the prevalence of *Ascaris lumbricoides* was 90.4%,*Trichuris trichiura* 78.4 % and *hookworm* 44.2 %. In Trunyan, an isolated village located more than 1000 meters above sea-level, the prevalence of A*scaris lumbricoides* was 84.7 %, *Trichuris trichiura* 41.2 % and *hookworm* 30.5 %. They concluded that the prevalence

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of *Trichuris trichiura* and *hookworm* in Trunyan was significantly lower than that in the other two villages[1].

In a similar survey carried out in Kedisan, Gianyar Regency, 40 km northeast of Denpasar, Bakta et al found that of 171 adults examined, 77.8 % were infected by *Ascaris lumbricoides*, 72.5 % by *hookworm* and 64.3 % by *Trichuris trichiura*[2]. In Br. Saba, Penatih, Badung Regency, 8 km north of Denpasar, Bakta et al found the prevalence of *Ascaris lumbricoides* to be 85.4 %, *T. trichiura* 88.4 % and *hookworm* 42.7 %, of 164 adults examined. Over 80 % of them had multiple infection, the most frequent being the combination of *Ascaris lumbricoides* and *Trichuris trichiura*[3].

Over 300 school children of seven primary schools throughout Badung Regency were examined for helminthic infections and 95.9 % was infected by *A. lumbricoides* 60.5 % by *T. trichiura* and 19.2 % by *hookworm* There was no definite difference in the prevalence of *A. lumbricoides* and *T. trichiura* in school children in rural and urban areas, but the prevalence of *hookworm* in the rural areas appeared to be higher[4].

In a Bali-wide baseline data survey on the integrated family planning and nutrition program, over 1200 children under five years of age were examined for intestinal helminthic infections. 59.7 % of the children harboured *A. lumbricoides*, 13.8 % *T. trichiura* and 3.3 % *hookworm*[5]. The definite lower prevalences of infection in children under 5 years old in comparison with those of school children, adults, and the general population may be partly due to less exposure to infection in the former group.

Relatively lower prevalences were also reported by Bakta et al to evaluate intestinal helminthic infections among over 1000 adult in-patients admitted for other diseases in the Medical Unit of the General Hospital, Denpasar. They found that 40.7 % of the patients harboured *A. lumbricoides*, 25.8 % *T. trichiura* and 23.0 % *hookworm*[6].

Few studies have been done to evaluate the infection intensity of the helminths. Bakta et al in their survey in Br. Saba, Penatih, assessed the infection intensity by counting eggs per gram of faeces (EPG) and the number of worms expelled after anthelmintic treatment. Results of the EPG counting by Kato Katz technique showed an average EPG of 3570.0 for *A. lumbricoides*, 655.4 for *T. trichiura* and 1118.8 for *hookworm*. They classified the infection of *A. lumbricoides* and *T. trichiura* as light and moderate infection, with the greater percentage of the two species being light infection. The infection rates of hookworm were very light, light and moderate infection, mostly being very light infection. The average number of worms expelled by one patient after treatment was 6.8 worms for *A. lumbricoides*, 17.3 for *T. trichiura* and 22.6 for *hookworm*[3].

The work by Widjana and Kapti to evaluate the infection intensity of ascariasis cases in Br. Pande, Renon, Denpasar, showed that of 143 ascariasis cases 63.6 % belonged to light infection, 30.8 % moderate infection and 5.6 % severe infection. The average EPG was 12241.8. The infection intensity was significantly greater in the younger patients (aged up to 13 years), in the low-education people and in the group of patients who did not have latrines in their houses[7].

The most prevalent species of hookworm in Bali is by far *Necator americanus*. Bakta et al[3] studied the species of hookworms expelled after treating 31 patients and found *Necator americanus* in 83.9 % and *Ancylostoma duodenale* in 16.1 %. Wartana et al[8] also found that *Necator americanus* was highly

predominant over *Ancylostoma duodenale*. In an ongoing study of hookworm infection and the related iron deficiency anaemia in the population of Bali, so far it have been found that *Necator americanus* was predominant.

It can be concluded that the infections of *Ascaris lumbricoides, Trichuris trichiura* and hookworm are equally distributed throughout Bali. Variation of the prevalence rates of each species may be due to differences in survey locations, in age groups of the people examined, and in the methods of examination employed. In almost all cases, however, *A. lumbricoides* infection has the highest infection rate, followed usually by *T. trichiura* and hookworm in decreasing percentages. It is clear from the data that infection of hookworm is usually found in rural areas.

Such wide distribution of the soil-transmitted helminthic infections is associated with very poor sanitary conditions in the community, particularly in rural areas. For Indonesia at large it is estimated that 79.3 % of households do not have latrines[9]. The condition in Bali is the same : 65.5 % of households do not posess latrines[5]. Even a survey in Br. Kelod, Renon, in the boundary of Denpasar, showed that latrines are not available in 35 % of the households[10]. It is therefore still a habit of many people to defecate indiscriminately on the fields, in the bushes and in the stream[5,10]. Thus, pollution of the environment with infective forms of the helminths can take place continuously. Such degree of pollution was demonstrated by Widjana and Kapti in Br. Pande, Renon, Denpasar, where the prevalence of *A. lumbricoides* was 87.2 %, who reported that *Ascaris* eggs could be isolated from the soil of 50 % of household yards[7]. Widjana and Kapti in another survey found that 12.6 % of vegetables commonly sold in eight market places in Denpasar were contaminated by eggs of *Ascaris*, larvae of *Strongyloides* and eggs of hookworm, with *Ascaris* eggs being the most frequent contaminant[11].

A clinical trial of mebendazole (Vermox) and pyrantel pamoate (Combantrin) was carried out on 120 Bali Hyatt Hotel employees by Rai. Sixty infected subjects were given mebendazole at a dose of 100 mg twice a day for three consecutive days and sixty other patients were given a single dose of 750 mg pyrantel pamoate. Mebendazole gave a cure rate of 98.1 % for *A. lumbricoides*, 92.7 % for *T. trichiura* and 88.4 % for *hookworm*. Pyrantel pamoate gave a cure rate of 96.6 % for *A. lumbricoides*, 22.6 % for *T. trichiura* and 81.6 % for *hookworm*. Side effects of the two drugs were minimal and transient. It is concluded that mebendazole and pyrantel are equally good for *A. lumbricoides* and hookworm infections, but pyrantel is less effective than mebendazole for treating *T. trichiura* infection[12].

2. Enterobius vermicularis

By far the only helminth of the group called "contagious helminths" ever reported in Bali is *Enterobius vermicularis*. In some surveys on intestinal helminthic infections by stool examination *E. vermicularis* infections were sometimes encountered. For example, Rasidi et al using formalin-ether method found a prevalence rate of 0 % to 3.1 % in three seperate villages[1]. A prevalence of 1.7 % was found by Bakta et al in Kedisan, by direct smear method[2]. By the same method no *E. vermicularis* infection was detected in 205 stool examinations done at the Health Laboratory, Denpasar[13]. Because of the manner in which egg deposition occurs, eggs of this helminth are seldom found in the stool. However, when adhesive cellophane tape

perianal swabbing is employed, a much higher prevalence rate can be found as shown by the following reports. A prevalence rate of 26.4 % was found by Rai et al in 208 children aged 1-15 years in Bualu, a coastal village south of Denpasar[14]. In Songan, a cold isolated village on Lake Batur, Widjana et al found a prevalence of 37.0 % in children and adults, with the 6-17 years age group being most infected[15]. In the rural village of Seraya, Karangasem Regency, a much higher prevalence of 53.3 % was found in the general population[16]. The average prevalence among primary school children throughout Badung Regency was found to be 18.4 %. The prevalence of the school children in rural areas of the regency was definitely higher (29.1 - 33.3 %) than in semi-urban areas (6.2 - 12.5%)[4]. The tendency of the prevalence rate being high in rural areas as reported may be partly due to crowded and poor housing conditions and bad personal hygiene of the population. Overcrowding is one of the important factors in causing the high infection rate such as demonstrated by the results of a survey carried out by Sutisna et al in an orphanage in Denpasar. This orphanage house is not more than 80 square meters large, but occupied by at least 65 people aged 4-29 years. The prevalence of *E. vermicularis* among t hese orphans was found to be 38.3 % and fingernails of two children were found to be contaminated by *E. vermicularis* eggs[17].

Results of the surveys have shown that the prevalence rate of *E. vermicularis* is higher in males than in females and the school children (aged 6-15 years) are the most frequently infected[14,15,16,17]. School children have a longer closer association among themselves than the other age groups.

3. Taenia saginata and Taenia solium

Bali has long been known to be endemic for taeniasis, besides some other parts of Indonesia. Ngoerah has reported having treated an average of 50 taeniasis patients a year in one hospital in Denpasar[18]. However, there have been a limited number of surveys on taeniasis and cysticercosis that have been carried out in Bali so far.

Simanjuntak et al using formalin-ether concentration technique found a prevalence of taeniasis of 0.8 % in Trunyan, 2.1 % in Sukawati and 3.3 % in Padangsambian[19]. They considered the lower prevalence rate in Trunyan to be due to the habit of eating more fish by the local population. A prevalence rate of 9.4% was found by Widjana et al in Jagapati, Badung Regency, by using interview[20]. In Br. Saba, Penatih, Badung Regency, Bakta found an infection rate of taeniasis to be 23.0 % in adults by using simple smear method[21]. Sutisna[10] reported a prevalence rate of 7.1 % in Banjar Kelod, Renon, Denpasar, by using formalin-ether technique, cellophane tape perianal swab and interview.

The prevalence of taeniasis was found to be higher in males than in females[10,20,21]. Probably males have the habit of eating more food containing raw meat than females. Most to all of the taeniasis patients have the habit of eating "lawar", a Balinese traditional food made of minced raw meat, usually pork or beef, grated coconut, vegetables, blood, and spices[10,21]. In addition to the very poor sanitary conditions of the people and the habit of permitting their cattle and pigs to roam free, this specific food, which is very popular all over Bali, is considered the source of the Taenia infections.

As for the species, *Taenia saginata* and *Taenia solium* are both found in Bali. By far *Taenia saginata* has been found to be much

more prevalent than *T. solium*. Bakta et al identified 8 Taenia worms and found 7 to be *T. saginata* and 1 *T. solium*[21]. Simanjuntak et al identified 2 *T. saginata* and 2 *T. solium* from 4 worms examined[19] while Sutisna confirmed 27 *T. saginata* and 1 *T. solium* of 28 worms studied[10]. Koesharjono et al further identified only *T. saginata* of 54 cases[22]. This very high prevalence of *T. saginata* may or may not reflect the actual situation in Bali at large since these results are mostly obtained from surveys carried out in the Badung Regency only.

It is well known that the Balinese people are very fond of eating both pork and beef lawar. Usually, as seen in Br. Saba, Penatih, and Br. Kelod, Renon, pig slaughtering is linked to occasional ritual ceremonies in which people consumed pork lawar collectively. Whereas beef lawar is sold daily in the local or nearby lawar stalls[10,21] It appears then, on the whole, that pork lawar is less frequently eaten by the villagers than beef lawar. Furthermore, because pig has a smaller carcass than cattle, it is possible that infection of the pork with cysticerci is more readily recognised by the villagers than the infection in beef. Thus, these might be two possible reasons why *T. saginata* is more prevalent than *T. solium*. And the suspicion that there might be a Taenia subspecies existing in Bali which morphologically looks like *T. saginata* but has pig as its intermediate host, is yet to be further clarified.

The presence of human cysticercosis in Bali has been documented by some workers. Ngoerah[18] reported clinically some cerebral cysticercosis cases in Wangaya Hospital Denpasar. Giri and Susanti histologically confirmed *T. solium cysticercus* in nodules of 2 and 6 Balinese patients respectively[23]. Results of serodiagnosis screening tests by ELISA have further confirmed the presence of cysticercus infections in the village of Tenganan and in all over Bali[24,25,26]

Examination by culturing samples taken from hands of children, women and men, washing and cooking and drinking water for evidence of lactose and indole producing bacteria in the village of Tenganan, showed 8-41 % of the people's hands and 88-93 % of the water were found to be contaminated by coliform bacteria[25]. Meanwhile Sutisna reported that fingernails of 5 (41.6 %) out of 12 taeniasis patients examined were found to be contaminated by Taenia eggs[28]. Such degree of faecal and egg contamination clearly suggest a possible exogenous route by which people may acquire cysticercosis.

Epileptic seizures were documented in 3% to 8% of the villagers interviewed by Simanjuntak et al[19] and in 1.1 % of the villagers interviewed by Sutisna [22]. The number of epilepsy cases in Bali is not well documented. However, at Wangaya Hospital Denpasar the number of epilepsy cases seen in its neurological clinic has increased from 68 in 1980 to 368 in 1984 (Kondra, personal communication). There is no evidence as yet, however, that could link the majority of these epilepsy cases to cysticercosis. In 1985 there were only 2 cases with epilepsy seen in Wangaya Hospital specifically diagnosed being due to cysticercosis (Kondra, personal communication).

Praziquantel was tested for treatment of taeniasis at a single dose of 10 mg/kg body weight by Koesharjono et al on 54 *T. saginata* taeniasis cases. A cure rate of 70.3 % was achieved after three months follow-up and in 20.37 % of the cases treated scolices of *T. saginata* were expelled. The side effects of the drug were minimal[23]. Efficacy of praziquantel was also evaluated by Sutisna on 12 *T. saginata* taeniasis patients using the same dose as above. After treatment all patients

expelled *T. saginata* worms, 41.6 % of which were with scolices. A cure rate of 91.7 % after three months follow-up was achieved and side effects were minimal[27].

PROTOZOA INFECTION

1. Intestinal Protozoa

1.1. *Giardia lamblia*

To date a very limited number of data have been documented on intestinal protozoa infections in Bali. In the survey by Rasidi et al using formalin-ether concentration technique, a prevalence rate of *Giardia lamblia* infection of 1.4 % and 1.5 % was found in Padangsambian and Trunyan, respectively[1]. A prevalence rate of 5.6 % was reported by Widjana et al of 51 faecal samples examined at the Health Laboratory, Denpasar by formalin-ether concentration technique[28]. However, a previously reported result of 205 faecal examinations done at the same laboratory using simple smear method found no infection of *G. lamblia*[13]. Because of the small morphology, cysts or trophozoites of *G. lamblia* tend to be easily missed in a simple faecal examination.

1.2. *Entamoeba histolytica*

Rai et al documented a prevalence of *E. histolytica* infection of 1.4 % of 205 faecal samples examined by simple smear method[13]. By formalin-ether concentration technique, Rasidi et al found the prevalence rate of *E.histolytica* to be 2.9 % in Padangsambian, 4.0% in Sukawati and 8.4 % in Trunyan, which were in accordancewith the prevalences in other parts of Indonesia which are usually below 15%.

1.3. *Other intestinal protozoa*

Balantidium coli infection rate was found to be 3.5 % in Sukawati and 1.5 % in Trunyan. The non-pathogenic *Entamoeba coli* was found in 8.0 to 18 % of the people examined and very small percentages were found for the other non-pathogenic amoebae such as *E. hartmani, E. nana* and *Iodamoeba butschlii*[1].

2. Blood Protozoa (malaria)

Malaria is still a great health-problem in most parts of Indonesia except in the islands of Java and Bali. The malaria situation in Java and Bali is by far better than the situation in the other islands due to intensive control program of the disease in both islands. However, when one asks whether malaria exists in Bali (or Java), the answer is yes[29].

In 1980 the malaria situation in Bali was serious with an annual parasite incidence (API) of 0.85 per mil. In 1981 due to activated surveillance and control of breeding places of the vectors, the API declined to 0.28 per mil. The decline continued through 1982, 1983, 1984 and 1985 with API of 0.14 per mil, 0.14 per mil, 0.10 per mil and 0.06 per mil respectively. However, in 1986 the API increased again to 0.11 per mil[30,31].

Of the 8 regencies of Bali, there are 4 regencies known to be endemic for malaria, namely Buleleng, Negara, Karangasem and Klungkung[29]. From time to time outbreaks of malaria occur in these places. It has been well documented that outbreaks usually occur as imported cases from highly endemic places outside Bali, usually by Balinese transmigrants visiting their families and by fishermen coming from other malarious islands. Thus, with Anopheline vectors already

present locally, spread of the disease may occur to other people[31].

Plasmodium vivax has been found to be most prevalent in Bali[29], but in outbreaks the leading cause is mostly *P. falciparum*[31]. For example, in a malaria outbreak which occured in Malaya, Jembrana Regency, in June 1987, *P. falciparum* was the cause of 16 cases and *P. vivax* of 3 cases, of a total of 19 cases found[31].

As part of the control program strategy, chloroquine is used for prophylactic and presumptive treatment, and the combination of chloroquine and primaquine is used for the radical treatment of confirmed positive malaria patients[29,31].

CONCLUSION

A review has been given on parasitic infections in human in Bali. Infections of the soil-transmitted helminths, namely *Ascaris lumbricoides, Trichuris trichiura* and *hookworm* are very common. *A. lumbricoides* prevalence rate has been reported to be 40 to 95 %, *T. trichiura* 25 to 90 % and *hookworm* 20 to 70 %, in several places in Bali. *Enterobius vermicularis* prevalence rate has been reported to be 18 to 53 %. Taeniasis prevalence rate has been documented to be 0.8 to 23 % in somevillages, where *Taenia saginata* was found to be highly more prevalent than *Taenia solium*. In view of the fact that the Balinese people generally consume both pork and beef lawar, this finding seems to be rather paradoxical and the possibility of a subspecies which is morphologically similar to *T. saginata* but requiring pig as its intermediate host, is yet to be studied.

Malaria is still found in Bali especially in regions along the coasts of some regencies, although generally the infection rate is considered low. Prevalence rates of the intestinal protozoa such as *Giardia lamblia, Entamoeba histolytica, Balantidium coli* have been occasionally reported in low percentages.

REFERENCES

1. Rasidi, R., S.S. Margono, G.M. Simanjuntak, C. Koesharjono (1979). Intestinal Parasites in Villages of Bali. The Journal of the Indonesian Medical Association 5-6-7-8 : 3-5.
2. Bakta, I.M., D.N. Wibawa, T. Parwati, N. Lila, I.B. Putra, D. Sutenegara, R. Moerdowo (1981). Prevalensi Infestasi Nematoda Usus di Kedisan, Bali. MEDIKA 10 : 676-679.
3. Bakta, I.M., T. Parwati, H. Soewarno, R. Moerdowo (1986). Infeksi Cacing Usus Pada Penduduk Orang Dewasa di Banjar Saba Desa Penatih, Bali. Majalah Ilmiah Unud 14 : 98-108.
4. Faculty of Medicine Udayana University (1980). Seminar Masalah Infestasi Cacing pada Anak Sekolah Dasar di Kabupaten Badung.
5. Suryadhi, N.T., I.B. Tjitarsa, K. Dela, P. Sutisna, I. Susanti, K. Rastini (1982). The Baseline Data Survey on the Integrated Family Planning and Nutrition Program in Bali. The Population Studies Center Udayana University Denpasar.
6. Bakta, I.M., A. Pagehgiri, T. Parwati, D. Sutenegara (1979). Prevalensi Beberapa Nematoda Intestinal pada Penderita di Bagian Penyakit Dalam di RSUP Sanglah Denpasar. Presented at the 2nd Symposium of Infectious Diseases, Surabaya.
7. Widjana, D.P., N. Kapti (1989). Karakteristik Intensitas Infestasi Cacing Gelang (Ascariasis) di Banjar Pande, Desa Renon, Kecamatan Denpasar Selatan, Kabupaten Badung. Presented at the 3rd Regional Scientific Meeting of Parasitology, Surabaya.
8. Wartana, N., P. Sutisna, N. Kapti, Ariwati, T. Rai (1981). Efektivitas Pyrantel Pamoat (Combantrin) pada Infeksi Cacing Tambang. Majalah Kedokteran Universitas Udayana **34** : 8-11.
9. Adhyatma, M. (1981). Kebijaksanaan Pemberantasan Penyakit Cacing Yang Ditularkan Melalui Tanah di Indonesia. Proceedings of

the 2nd National Seminar of Parasitology, June 24-27: 424-427.

10. Sutisna, P. (1989). Masalah Taeniasis di Banjar Kelod, Renon, Denpasar. Presented at the 3rd Regional Scientific Meeting of Parasitology Surabaya.
11. Widjana, D.P., N. Kapti (1986). Cacing-cacing Yang Ditularkan Melalui Tanah (Soil-transmitted helminths) Pada Beberapa Bahan Sayur Dalam Lingkungan Kotif Denpasar. Majalah Kedokteran Universitas Udayana **52:** 30-35.
12. Rai, T. (1980). Intestinal Helminthic Infestation Among the Bali Hyatt Hotel Staff and Evaluation of Mebendazole (Vermox) and Pyrantel Pamoate (Combantrin) in Mass Treatment. Presented in the 1st Scientific Meeting of the Indonesian Association of Medical Parasitology and Microbiology, Denpasar.
13. Rai, T., P. Sutisna, D.P. Widjana, N. Kapti (1977). Survey Pendahuluan Mengenai Prevalensi Parasit-Parasit Intestinal di Laboratorium Kesehatan Denpasar. Majalah Kedokteran Universitas Udayana 22.
14. Rai, T., P. Sutisna, D.P. Widjana. Survey Infestasi Cacing Enterobius vermicularis Pada Anak-anak Prasekolah dan Anak- anak Sekolah di Bualu, Denpasar, Bali. Majalah Kedokteran Universitas Udayana 17.
15. Widjana, D.P., N. Wartana, T. Rai, N. Suyasa (1978). Infeksi Cacing Kremi di Songan Bangli. Majalah Kedokteran Universitas Udayana 24.
16. Wartana, N., P. Sutisna, D.P. Widjana, N. Kapti (1979). Infeksi Enterobius Vermicularis di Seraya, Karangasem. Majalah Kedokteran Universitas Udayana No. 26.
17. Sutisna, P., D.P. Widjana, N. Wartana, K. Ngurah (1987). Prevalensi Enterobiasis dan Beberapa Kemungkinan Sumber Penularannya Pada Anak-anak Panti Asuhan Darlene di Denpasar, J. Indonesian Family Physicians **8** (6) : 477-479.
18. Ngoerah, I.G.N. (1975). Cysticercosis Dari Susunan Saraf Pusat. Majalah Ilmiah Universitas Udayana **9** : 31.
19. Simanjuntak, G.M., S.S. Margono, R. Sachlan, R. Rasidi and B. Sutopo (1977). An Investigation on Taeniasis and Cysticercosis in Bali. Southeast Asian J. Trop. Med. Pub. Hlth. **8** : 494-497.
20. Widjana, D.P., N. Kapti (1983). Beberapa Aspek Taeniasis di Kecamatan Abiansemal Presented at the 2nd Scientific Meeting of the Indonesian Association of Medical Microbiology and Parasitology. Surabaya.
21. Bakta, I.M., H. Soewarno (1983). Taeniasis di Banjar Saba Desa Penatih Bali. Proceedings of the 3rd Congress of the Indonesian Association of Internists, Jakarta, July 24-29.
22. Koesharjono, C., S Sukartinah, C Windiyaningsih, W Panjaitan, I.M. Suarnawa, Subandi (1987). Praziquantel Sebagai Obat Untuk Pengobatan Taeniasis (Cacing Pita). The Indonesian Journal of Parasitology 1 (1) 23-31.
23. Giri, I.W. (1978). Cysticercosis in Surabaya. Southeast Asian J Trop Med Pub Hlth **9** 232-236.
24. Anonym. Tenganan Project : Follow-up 1978-1985. Final Report to the Indonesian Institute of Sciences (LIPI).
25. Coker-Vann, M.R., D.B. Subianto, P Brown, A.R. Diwan, R. Desowitz (1981). Elisa Antibodies to Cysticerci of Taenia soliuni in Human Populations in New Guinea, Oceania, and Southeast Asia. Southeast Asian J Trop Med Pub Hlth **12**: 499- 505.
26. Coker-Vann, M., P. Brown, D.C. Gajdusek (1984). Serodiagnosis of Human Cysticercosis Using Chromatofocused Antigenic Preparation of Taenia solium cysticerci in Enzym-linked Immunosorbent Assay (ELISA). Trans Royal Society. Trop. Med. Hyg. **78**: 492-496.
27. Sutisna, P. (1989). Kharakteristik Beberapa Penderita Taeniasis Saginata dan Efektivitas Praziquantel Untuk Pengobatannya (not yet published).
28. Widjana, D.P., T. Rai, P Sutisna, N. Wartana, Ariwati, N. Kapti (1980). Infeksi Giardia lamblia di Balai Laboratorium Kesehatan. Bulletin of the Indonesian Medical Association of Denpasar No. 4.
29. Department of Health Bali Province. Laporan Tahunan Informasi Kesehatan 1984/1985.
30. Semendra, I.W. Hasil Monitoring Trend Beberapa Penyakit Menular di Propinsi Bali Th. 1980-1984.
31. Suega, K. (1987). Penanggulangan Letusan Kasus Malaria di Kecamatan Melaya Kabupaten Dati II Jembrana. Presented at the Seminar of the Indonesian Association of the Control of Parasitic Diseases, Denpasar (August 8).